Saving North America's Greatest Aquifer by Fax

The "Water Smart" column that appears daily in the Amarillo Globe News provides urban lawn watering guides based on data from the North Plains Evapotranspiration Network. The network also faxes data to farmers to advise them of when and how much to water.

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The Ogallala Aquifer—the largest underground water supply in North America—still has plenty of groundwater to pump for irrigation, despite dire predictions that it would run dry by now. In fact, the Texas Panhandle, which is over the shallowest part of the aquifer, has a plan in place to extend its useful life through at least mid-century, according to agricultural engineer Thomas H. Marek, of the Texas Agricultural Experiment Station (TAES) in Amarillo. "It's important to do this because irrigation is the lifeblood of the Panhandle area."

Underpinning this plan is the North Plains Evapotranspiration (NP ET) Network, built by a team of seven scientists—including Marek—from three agencies.

Evapotranspiration is the technical term for all water either used by plants or lost through evaporation, explains team member Terry A. Howell, an Agricultural Research Service agricultural engineer in Bushland, Texas.

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Agricultural engineers Terry Howell (left) and Thomas Marek maintain a weather station at the ARS Bushland experimental North Plains Evapotranspiration Network.

For information about how plant growth and water use relate to weather conditions, the network relies on 10 years of ARS crop water-use data collected in Bushland, Howell says.

"The NP ET network allows accurate estimates, crop by crop, county by county, of present-day water use by farmers," says John M. Sweeten, TAES resident director.

"Irrigation pumps aren't metered, so agricultural use predictions can be based only on irrigation survey data and plant water-use data," says L. Leon New, extension irrigation engineer with the Texas Agricultural Extension Service in Amarillo. "The network helps farmers save water by advising them of the best time to start watering, and in what amounts, and when to stop watering—based on knowledge of crop water needs and local conditions."

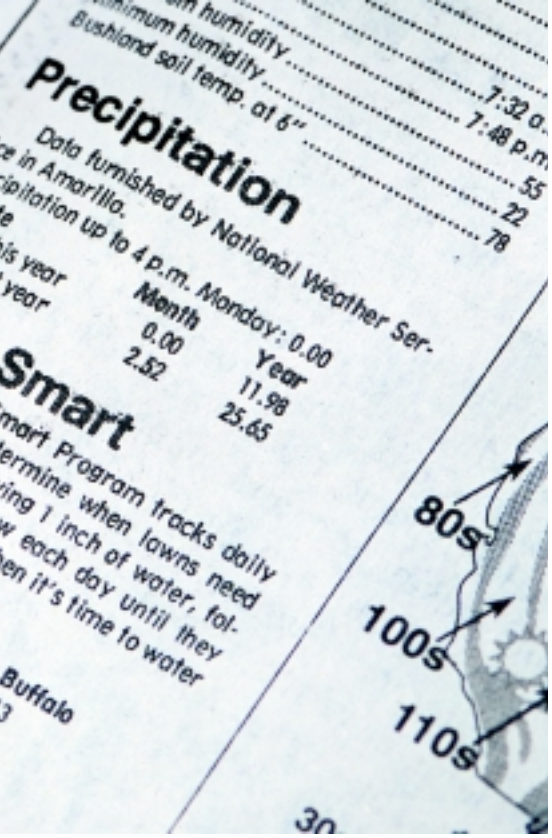
Last year, the network sent more than 300 fax alerts a night. Subscribing farmers saved an estimated 20 billion gallons of precious Ogallala Aquifer water and lowered irrigation pumping costs by an estimated $5 million a year—while raising or maintaining yields.

The Ogallala is a giant sponge of sand and gravel soaked with rainwater and snowmelt, stored mostly when the eastern portion of the Rocky Mountains eroded more than a million years ago. It underlies most of the Great Plains states. The Ogallala's predicted decline has been cut by a third recently, in part because of the network of weather stations, according to Howell.

"Some of this is simply a correction because of better data and numbers from the network, and the rest is because of less land being irrigated and more efficient irrigation systems available now, coupled with the fax alerts," says Howell.

Maintaining the network's 1,500-mile circuit of weather stations 7 days a week, 24 hours a day, is a daunting task. The network maintains two stations in reserve in case it has to close one or two stations for repairs. The team devised a computer program that checks incoming data to spot errors that might result from faulty equipment. One team member comes in early each morning to make a visual check of the data through computer-generated graphs. If repairs are needed, a team member has to drive immediately to the station where equipment has failed.

Texas' North Plains Underground Water Conservation District recently



used weather-station data, crop water-use data, and other information, such as county-irrigated acreage and irrigation surveys, to predict Ogallala water depletion with near 100 percent accuracy when measured against actual depletion. "We could never predict that accurately with the old method, which involved many judgment calls—and little data," Sweeten says.

The North Plains network was formed in 1994, supplementing a 1992 network that covers the Southern Texas High Plains. In 1995, Guy Fipps, at Texas A&M University, College Station, set up Texaset, a network that covers the north central and southern parts of the state. ARS worked with Texas A&M University in College Station, Texas Tech University in Lubbock, TAES, the Texas Agricultural Extension Service, and others to develop the network.

Howell has compiled 10 years of data on crop water use gleaned from four of the few "weighing lysimeters" existing in the world. These lysimeters are giant pieces of farm fields, each balancing on an underground scale that measures any weight change from water added or lost.

Many crops are grown in the lysimeters, including corn, soybeans, wheat, cotton, sorghum, and tall fescue grass. A local school district uses the faxed data for grass to save on its lawn watering.

"That's what we hope to see more of," Sweeten says, referring to urban users. He wants to see the NP ET network spread not only throughout North Plains farms, but also in towns and cities like Amarillo, Lubbock, and Dallas.

What the NP ET has done for the Ogallala Aquifer, its principles can do for urban, as well as rural, water users anywhere. "Urbanites would do well to study the water conservation principles developed by the Terry Howells and Tom Mareks of the world," says Sweeten.

Sweeten, Howell, New, and Marek want to get the word out to more farmers in the North Plains. The *Amarillo Globe News* publishes the crop water-needs advisories daily. Local Amarillo radio and TV stations also report the evapotranspiration rate data. The NP ET and many other networks are available on the World Wide Web. The networks have "robot programs" that automatically capture data from other networks and store it on their web sites. Howell recently worked with colleagues to update and publish a list of all these networks at the Irrigation Association's ET Connection at http://www.irrigation.org.

The NP ET network doesn't provide storm warnings, but it will do about everything else, including giving pest alerts. In fact, the summer of 2000 was the first time farmers and consultants woke up to corn rootworm alerts faxed from the network, giving advance notice to get ready to spray because an outbreak was imminent.

The Texas legislature recently approved the purchase of numerous field weather stations to create the densest such network in Texas to date. It's modeled after Oklahoma's Mesonet, which has provided statewide coverage, including storm warnings, since 1995.

Texas Senate Bill 1 requires the establishment of regional water plans throughout the state for implementation on January 5, 2001. These plans will be incorporated into an update of the statewide water plan in January 2002. The NP ET network is identified as one of the recommended water-management strategies. Also, the Panhandle Regional Water Planning Group is using network data to forecast irrigation needs for the next 10 to 50 years.

The Panhandle group's goal is to make sure the wells dug into the Ogallala after the intense drought of the mid-1950s don't run dry.—By **Don Comis,** ARS.

This research is part of Water Quality and Management, an ARS National Program (#201) described on the World Wide Web at http://www.nps.ars.usda.gov.

Terry A. Howell is with the USDA-ARS Conservation and Production Research Laboratory, P.O. Drawer 10, Bushland, TX 79012-0010; phone (806) 356-5746, fax (806) 356-5750, e-mail tahowell@ag.gov.

John M. Sweeten, Thomas H. Marek, and L. Leon New are at the Texas A&M Agricultural Research and Extension Center, 6500 Amarillo Blvd. West, Amarillo, TX 79106; phone (806) 359-5401, fax (806) 358-9718, e-mail j-sweeten@tamu.edu t-marek@tamu.edu l-new@tamu.edu. ◆

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Research associate Don Dusek, an ARS collaborator with the Texas Agricultural Experiment Station at Amarillo, observes a graph of data from weather stations.